United States Department of Agriculture
NRCS Natural Resources Conservation Service

Waste Storage Facility:

Preventing Fires in Litter Storage Structures

Alabama Job Sheet No. AL313

Definition

Litter stacks and even dead animal compost can catch fire if not properly maintained. Storing poultry litter in a covered storage structure is a good management technique. It provides flexibility in timing applications to the land; prevents the possibility of polluting surface or ground waters, as could occur with litter stored outdoors; and is a good way to maintain quality feed for cattle. However, careful management must occur to prevent fires.

Operation and Maintenance

Background Information

It has long been known that heat is generated when microbiological activity occurs in an insulated environment, such as a garden compost pile or even dairy manure stored outside. Overheating and spontaneous combustion in hay barns, coal piles, land fills, and barrels of oily rags are not uncommon. Both biological and chemical factors may be associated with litter storage fires, although the exact causes are not fully known.

Fires and explosions have occurred in unvented sanitary landfills due to the generation of combustible methane. In order for methane to be generated, conditions must be right for the growth of anaerobic bacteria. This includes proper moisture content (greater than 40%) and an oxygen-free or low-oxygen environment. Methane has a specific gravity less than air and, therefore, can escape to the atmosphere if a proper conduit is provided (i.e., adequate pore spaces in the surrounding litter). Methane is flammable in air at concentrations of 5 to 15 percent. As such, the production of methane in litter storage is a potential hazard.

Another phenomenon, called the heat of adsorption, can occur when dry matter such as litter comes into contact with moist material or even moist air. As the dry material adsorbs water vapor, heat is released. In an insulated environment this generated heat can be significant. The heat from this process begins to dissipate when the moisture occupies or is adsorbed to all the available attachment sites in the dry material.

However, another process, called pyrolysis or heat of oxidation, can take over at higher temperatures, usually between 250°F to 400°F. This process is self-sustaining as long as adequate oxygen is available.

Thus, the processes that relate to the generation of heat are both biological and chemical. However, since most bacteria are killed between 130°F and 165°F, chemical reactions are ultimately responsible for the processes that lead to combustion.

The Delaware NRCS, Cooperative Extension System, and Conservation Districts conducted a survey of poultry producers to identify management practices that tended to cause fires and overheating in dry stacks. Eighty producers were interviewed. They found that seven dry stacks had experienced one or more fires. An additional twelve experienced excessive heat during the storage period. A statistical analysis did not reveal a single common cause of all fires, but it did reveal that common factors were prevalent in nearly all cases.

Study Findings

Moisture: Moisture was found to be a critical factor in all manure pile fires. All structures having fires had litter from houses with plasson waterers or water troughs in some or all the houses. One pile was also exposed to wind-driven rain. These findings suggest that higher moisture levels caused more heat to be generated in the piles.

Layering: Piles that experienced fires were all layered either horizontally (new litter stacked on top of old) or at an angle (litter pushed against the sloping sides of old litter). (NOTE: Layering brings into contact old litter that can be very dry and new litter that may be moist. The boundary between the two layers becomes an insulated, heat-producing area.)

Compaction: The majority of piles that experienced fires were compacted. Heat is not easily released from a compacted pile.

Pile Size: The pile height and width were found to be more critical than pile length. The larger the pile size (cross sectional area) the greater the chance for excessive heat or fire. Heat is more easily released from a smaller pile because of its larger ratio of surface area to volume.

Recommendations

In order to reduce the potential for fires in litter storage structures the following is recommended:

1. Pile height should not exceed 7 feet. Storing the material in separate small windrows reduces the cross sectional area and is the safest option for stacking.

2. KEEP THE LITTER DRY! Do not wet the litter in the hope of preventing a fire; just the opposite may occur. In addition, protect the litter from blowing rain.

3. Avoid placing the wet material in contact with dry material. Do not layer new litter on top of old, and do not let dead poultry compost come into contact with stored litter.

4. Do not compact the material by driving over it or packing it with equipment.

5. If litter is stored against wooden walls, limit the litter height to 4 feet.

6. Monitor temperatures at different points in the pile frequently. If temperatures exceed 190°F, or if the material is smoldering, prepare to remove material from the building. This includes notifying the local fire department to be on hand. A smoldering pile could burst into flames if exposed to air. A garden hose could be inadequate to extinguish the fire.

7. Do not store expensive equipment in the litter storage structure.

References

Alabama NRCS Job Sheet No.
Composting Poultry Mortality - AL 317
Composting Swine Mortality - AL 317A

3/09

Preventing Fires in Litter Storage Structures Worksheet

Land User: _____ **County:** _____ **Date:** _____

Farm No.: _____ **Tract No.:** _____ **Assisted By:** _____

Maximum pile height planned: _____ ft.

Height of litter stacked against wooden walls: _____ ft.

Provisions to keep litter dry: _____

Provisions to separate dry litter from wet litter or compost:

_____

Method used to monitor temperatures: _____